

IN THE FIGURES

Please **replace** FIGs, 12A and 12B with the enclosed figures. Replacement figures include the legend "Replacement Sheet." No new matter is included. The figures have been amended to include concave/convex surfaces on the first substrate 10 and the second substrate 30, which is disclosed on page 36, line 17, et seq.

#### FORMALITIES

The Examiner objects to the Specification, asserting that it does not show any concave/convex surfaces of the substrates as recited in claim 8. The Applicants respectfully direct the Examiner's attention to FIG. 9 and the discussion of Embodiment 2 beginning on page 32 of the Specification in which a resin layer with a "continuous wavy shape" is disclosed.

#### REMARKS

Claims 1 through 9 are pending in the subject application. Claims 1-9 stand rejected under 35 U.S.C. 103(a). Claim 8 is further rejected under 35 USC 112, first and second paragraphs and claim 4 is further rejected under 35 USC 112, second paragraph. Claims 4 and 8 have been amended. Replacement figures 12A and 12B have been amended.

The Applicants appreciate the Examiner's thorough examination of the subject application and respectfully request reconsideration of the subject application based on the above amendments and the following remarks.

#### 35 U.S.C. § 112, FIRST PARAGRAPH REJECTION

The Examiner has rejected claim 8 under 35 USC 112, first paragraph for containing subject matter not described in the specification. The Applicants respectfully disagree. Claim 8 refers to Embodiment 2 and FIG. 9 in the Specification for which there is adequate enablement and not to Embodiment 3 and FIG. 12.

Accordingly, the Applicants assert that the claim 8 satisfies all of the requirements of 35 U.S.C. 100 et seq., especially § 112, first paragraph. As such, the Applicants believe that the claim is allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action

is requested.

35 U.S.C. § 112, SECOND PARAGRAPH REJECTIONS

The Examiner has rejected claims 4 and 8 under 35 USC 112, second paragraph as being indefinite for failing to point out and distinctly claim the subject matter that the Applicants regard as their invention. More specifically, the Examiner asserts that claims 4 and 8 are indefinite. The Applicants have amended claims 4 and 8 and believe that the grounds for rejection are moot.

Accordingly, the Applicants assert that the claims 4 and 8 satisfy all of the requirements of 35 U.S.C. 100 et seq., especially § 112, second paragraph. As such, the Applicants believe that the claims are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

Moreover, the Applicants respectfully assert that, the amendments are not claim narrowing as that term is understood under *Festo* and that, the Applicants make such amendments without intent to surrender any of the equivalents thereto.

35 U.S.C. § 103(a) REJECTION

The Examiner has rejected claims 1, 2, 4-6, 8, and 9 under 35 USC 103(a) as unpatentable over U.S. Patent Number 6,377,321 to Khan, et al. ("Khan" or the "Khan Reference") in view of Japanese Published Laid-Open Patent Application JP 06-102485A ("Okada" or the "Okada Reference"); claim 3 under 35 USC 103(a) as unpatentable over Khan in view of Okada further in view of U.S. Patent Number 6,414,669 to Masazumi ("Masazumi" or the "Masazumi Reference"); and claim 7 under 35 USC 103(a) as unpatentable over Khan in view of Okada further in view of U.S. Patent Number 5,880,801 to Scherer, et al. ("Scherer" or the "Scherer Reference"). The Applicants respectfully traverse these rejections for the reasons provide below and the amendments above.

Claims 1, 2, 4-6, 8, and 9

The present invention discloses a liquid crystal display device comprising a pair of opposing substrates, a liquid crystal layer ("LC layer") having a helical structure and exhibiting at least two stable states, e.g., a planar state and a focal conic state, which is interposed between the substrates, and a plurality of pixels arranged in a matrix pattern. Furthermore, in each of the plurality of pixels, there are at least two different distances  $dA_1$ ,  $dA_2$ , etc. between the opposing substrates; and the LC layer includes at least two regions having different threshold voltage values. The purpose of this structure makes:

it possible to transition the liquid crystal layer include in one region in a pixel to the focal conic state while maintaining the liquid crystal layer included in another region in the same pixel in the planar state. As a result, it is possible to realize an intermediate gray level display and a multiple gray level display \*

\* \*

Specification, page 14, lines 11-17. (Emphasis added). For example:

In order to produce a display with a high contrast ratio, it is preferred that the thickness  $d$  of the liquid crystal layer 30 is defined so that  $V_{thFmax}$  (the first threshold voltage for transitioning the liquid crystal layer 30 included in a region with the largest thickness  $d$  of the liquid crystal layer 30 from the planar state to the focal conic state) is less than  $V_{thHmin}$  (the second threshold voltage for transitioning the liquid crystal layer 30 included in a region with the smallest thickness  $d$  of the liquid crystal layer 30 for the focal conic state to the homeotropic state) in each of the plurality of pixels.

Id., page 26, lines 8-18.

The Examiner admits that the Khan reference does not necessarily teach a thickness  $d$  in each of the plurality of pixels to have at least two different values. Indeed, all of the figures in Khan show a thickness  $d$  of common dimension and, when discussed in the specification, spacing between substrates is of a uniform thickness. See, e.g., Khan, col. 11, lines 1-4 and lines 32-35. Thus there is no teaching, mention

or suggestion in Khan to provide an LCD device having opposing substrate that have at last two different thickness values.

The Examiner also admits that the Khan reference does not necessarily teach a single liquid crystal layer that includes at least two regions having different values of a threshold transition voltage. Indeed, Khan teaches a combination of at least two separate LC layers wherein

[t]he first liquid crystal layer 22 includes a concentration of chiral material that provides a pitch length effective to enable the material to reflect visible light. The second liquid crystal layer 26 includes a concentration of chiral material that provides a pitch length effective to enable the material to reflect infrared radiation.

Id., col. 10, lines 42-47 (Emphasis added). Thus, Khan is concerned with concentrations of chiral materials as a function of light frequencies associated with visible and infrared light. There is no mention of a planar state or a focal conic state. Accordingly, Khan teaches away from a single LC layer and, moreover, teaches away from a single LC layer that includes at least two regions of different values of threshold voltage. Therefore, those of ordinary skill in the art would not have found the present invention obvious in view of the Khan reference.

Moreover, there is no teaching, mention or suggestion in the Khan reference to include a first thickness in the LC layer in which the first threshold voltage for transitioning the liquid crystal layer included in a region with the largest thickness of the LC layer from the planar state to the focal conic state that is less than the second threshold voltage for transitioning the LC layer included in a region with the smallest thickness of the LC layer for the focal conic state to the homeotropic state. Varying thicknesses in the different regions in a common LC layer simply are not contemplated by the Khan reference.

The Examiner relies on the Okada reference to make up for the shortcomings of the Khan reference. However, Okada (corresponding to U.S. Patent Number

5,719,651) does not teach varying thickness gradients to achieve different threshold voltages in different regions of the LC layer. On the contrary, Okada merely teaches that, to prevent union of domains, the width of a domain wall is greater than the closest proximity distance of domain walls. See, e.g., Okada, col. 6, lines 44-48; col. 8, lines 32-34. Okada does not teach, mention or suggest a liquid crystal layer with at least two stable states, i.e. planar and focal conic, that are a function of voltage or a liquid crystal layer having at least two regions having different voltage threshold values for transitioning the liquid crystal layer from the planar state to the focal conic state.

Accordingly, the Applicants assert that the claims 1, 2, 4-6, 8, and 9 are not made obvious by the cited references and, further, satisfy the requirements of 35 U.S.C. 100 et seq., especially § 103(a). As such, the Applicants believe that the claims are allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

### Claim 3

Nor can the Masazumi reference make up for the deficiencies of the Khan and Okada references. The Examiner asserts that it would have been obvious to define the thickness  $d$  of the liquid crystal layer in terms of a first and a second threshold voltage. However, Masazumi does not teach, mention or suggest any relationship between LC layers and voltages. Specifically, there is nothing to suggest that the region with the largest thickness  $d$  provides the threshold voltage for transitioning the LC layer from a planar to a focal conic state; or that the region with the smallest thickness  $d$  provides the threshold voltage for transitioning the LC layer from a focal conic to a homeopathic state; or that the latter threshold voltage ( $V_{thHmin}$ ) is greater than the former voltage ( $V_{thFmax}$ ).

Accordingly, the Applicants assert that the claim 3 is not made obvious by the cited references and, further, satisfies the requirements of 35 U.S.C. 100 et seq., especially § 103(a). As such, the Applicants believe that the claim is allowable.

Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

Claim 7

Nor can the Scherer reference make up for the deficiencies of the Khan and Okada references. Indeed, Scherer does not teach, mention or suggest a plurality of pixels with a LC layer having at least two different thickness values and including at least two different regions having different threshold voltage values for transitioning from a planar to a focal conic state.

Accordingly, the Applicants assert that the claim 7 is not made obvious by the cited references and, further, satisfies the requirements of 35 U.S.C. 100 et seq., especially § 103(a). As such, the Applicants believe that the claim is allowable. Moreover, it is respectfully submitted that the subject application is in condition for allowance. Early and favorable action is requested.

The Applicants believe that no additional fee is required for consideration of the within Response. However, if for any reason the fee paid is inadequate or credit is owed for any excess fee paid, you are hereby authorized and requested to charge Deposit Account No. **04-1105**.

Respectfully submitted,

Date: December 2, 2003

By: 

George W. Harthell, III  
Reg. No. 42,639  
Attorney for Applicant(s)

EDWARDS & ANGELL, LLP  
P.O. Box 9169  
Boston, MA 02209  
(617) 517-5523  
Customer No. 21874  
351491